How representation, relationships, and community act as 'social vaccines' for underrepresented students in STEM

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Core social motives drive human behavior

- Humans are a social species that rely on relationships to survive and thrive. A few social motivations drive human thinking, feeling, and behavior.

- **Need to belong**: We gravitate toward social environments where we feel we belong and away from others where we feel like misfits.

- **Need to feel competent and worthy**: We pursue activities that make us feel confident and worthy and move away from others that make us doubt competence and worthiness.

- These motivations guide human behavior in many situations including our academic and professional choices.

Yet impact of social motives on STEM pathways is underestimated

- We assume that talent and ability is all that is needed for and success in STEM.
- We assume high performance in STEM disciplines is the best predictor of persistence and success.
- We assume that young people who leave STEM pathways must be struggling in terms of performance.

Contrary to assumptions, research shows…

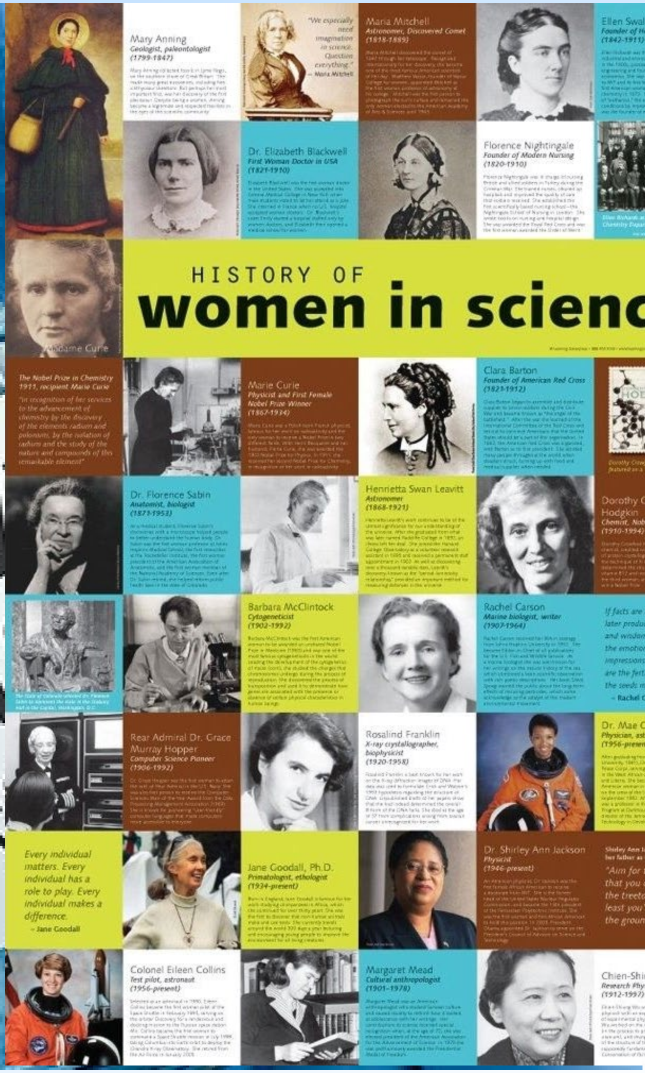
- People who are talented in STEM may initially approach STEM activities, but persistence depends on whether learning environment satisfies core social motives

- High performance is not sufficient for persistence if students' need to belong and to feel competent are not satisfied

- For people underrepresented in STEM, approaching STEM spaces activates negative stereotypes.

- These stereotypes plus scarcity of similar others threaten feelings of belonging and confidence, making young people move away from STEM pathways.

Stereotype inoculation model and ‘social vaccines’



Dasgupta (2011), *Psychological Inquiry*

Stout, Dasgupta, Hunsinger, & McManus (2011), *Journal of Personality and Social Psychology*

Two evidence-based solutions that satisfy social motives in STEM

Mentoring relationships with own-group peers

Learning community based on common identity

RELATIONSHIPS

Same-sex peer mentors as social vaccines

Peer mentors in the transition to college

Longitudinal study with first-year women in engineering (N = 150).

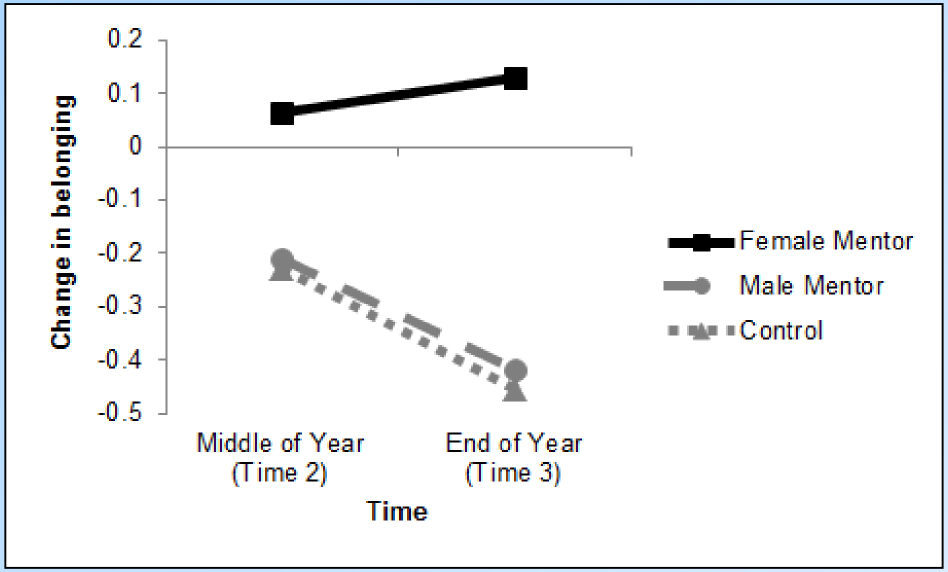
Random assignment to condition: female mentor, male mentor, or no mentor (control)

Mentor-mentees met for 1 year.

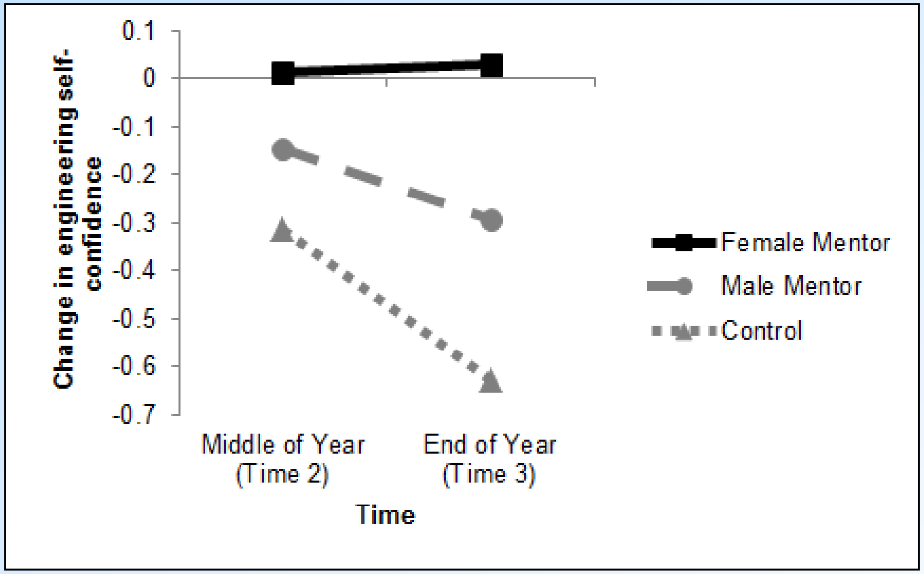
Tracked mentees' progress from 1st year through graduation long after mentoring had ended.

Belonging and confidence in engineering: 1st year of college

Belonging

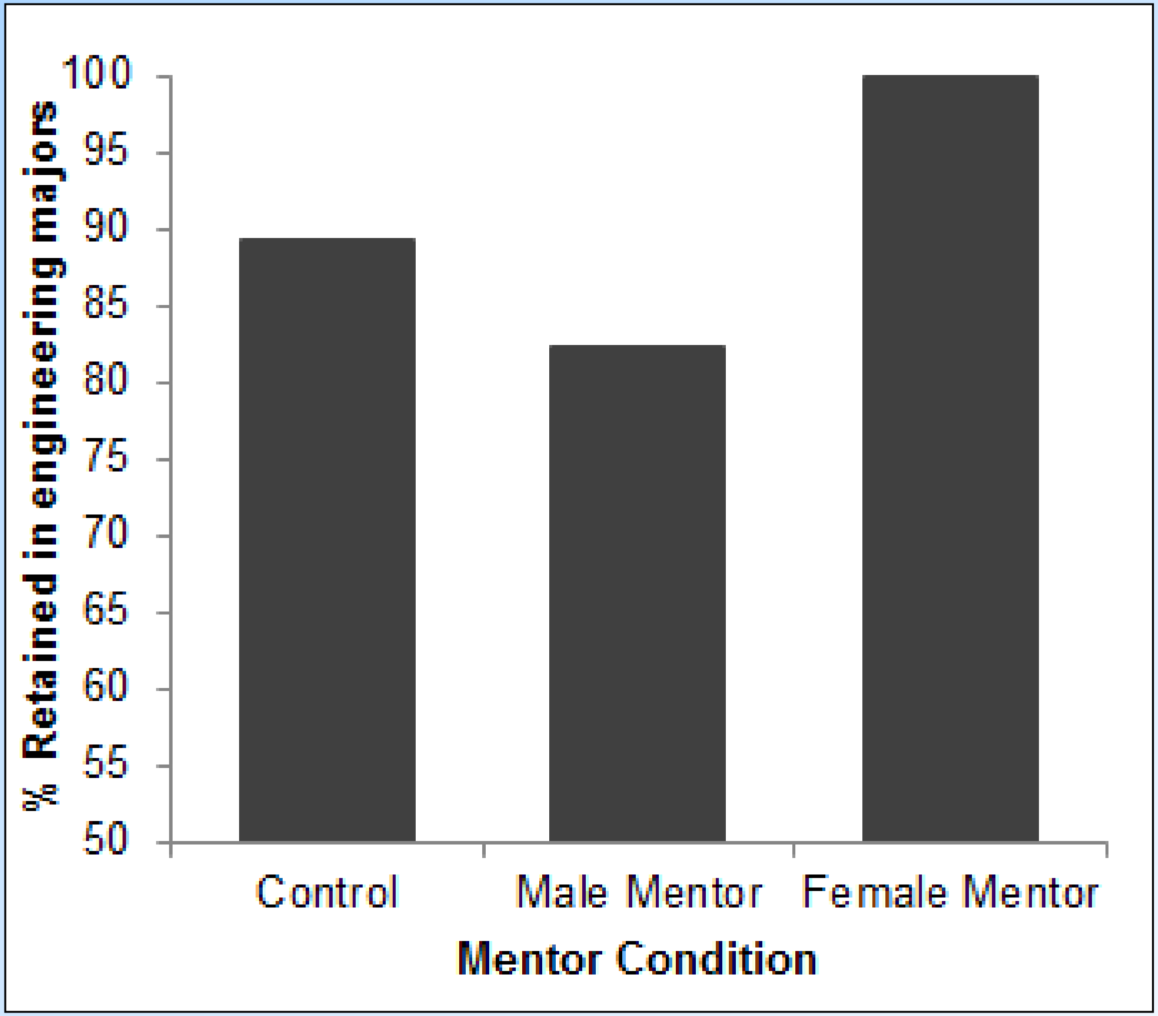


Confidence



Dennehy & Dasgupta (2017). *Proceedings of the National Academy of Sciences*

Women's retention in engineering majors: end of 1st year of college

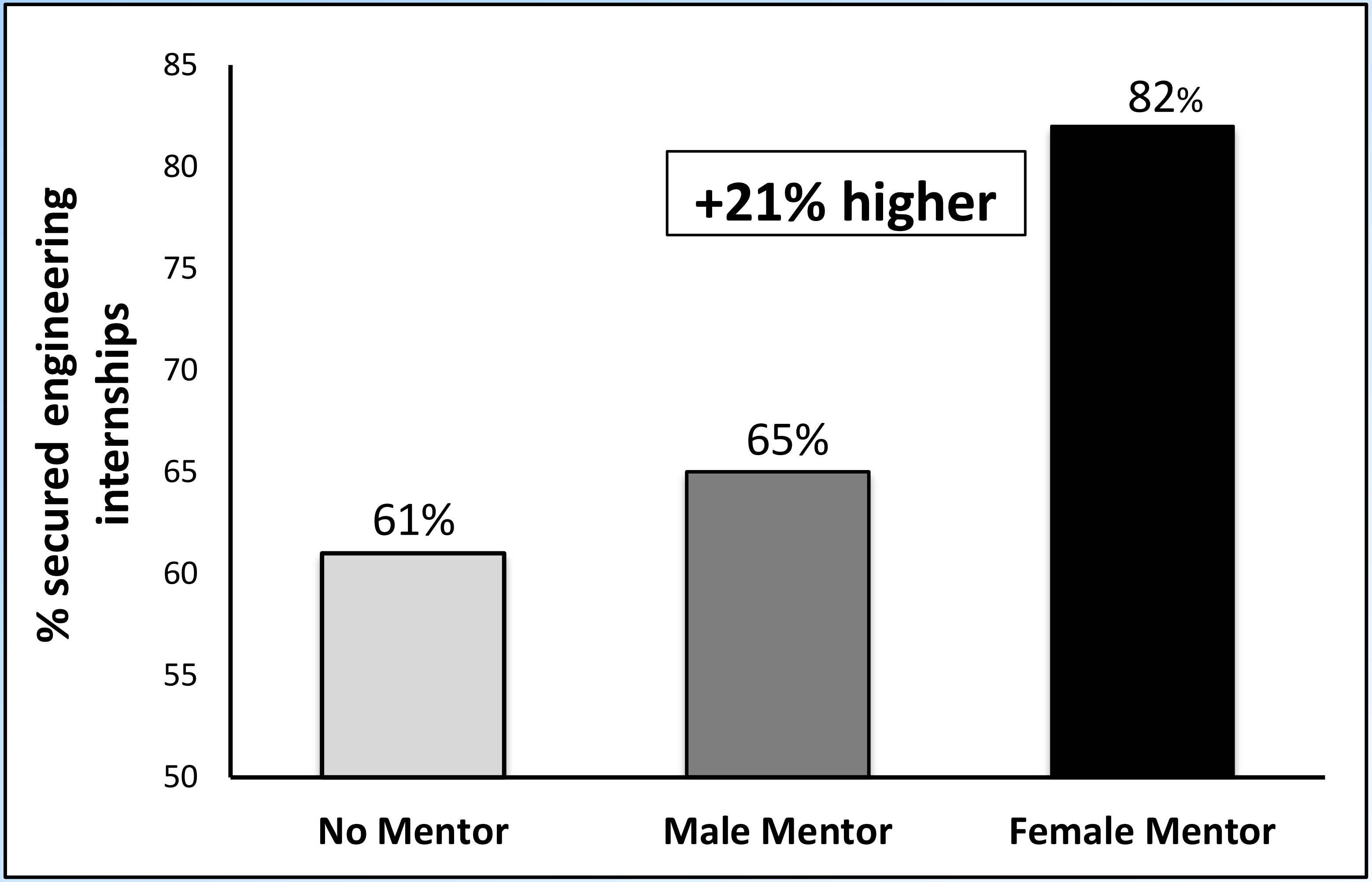


Dennehy & Dasgupta (2017). *PNAS*

Four years later at college graduation (Peer mentoring has long ended)

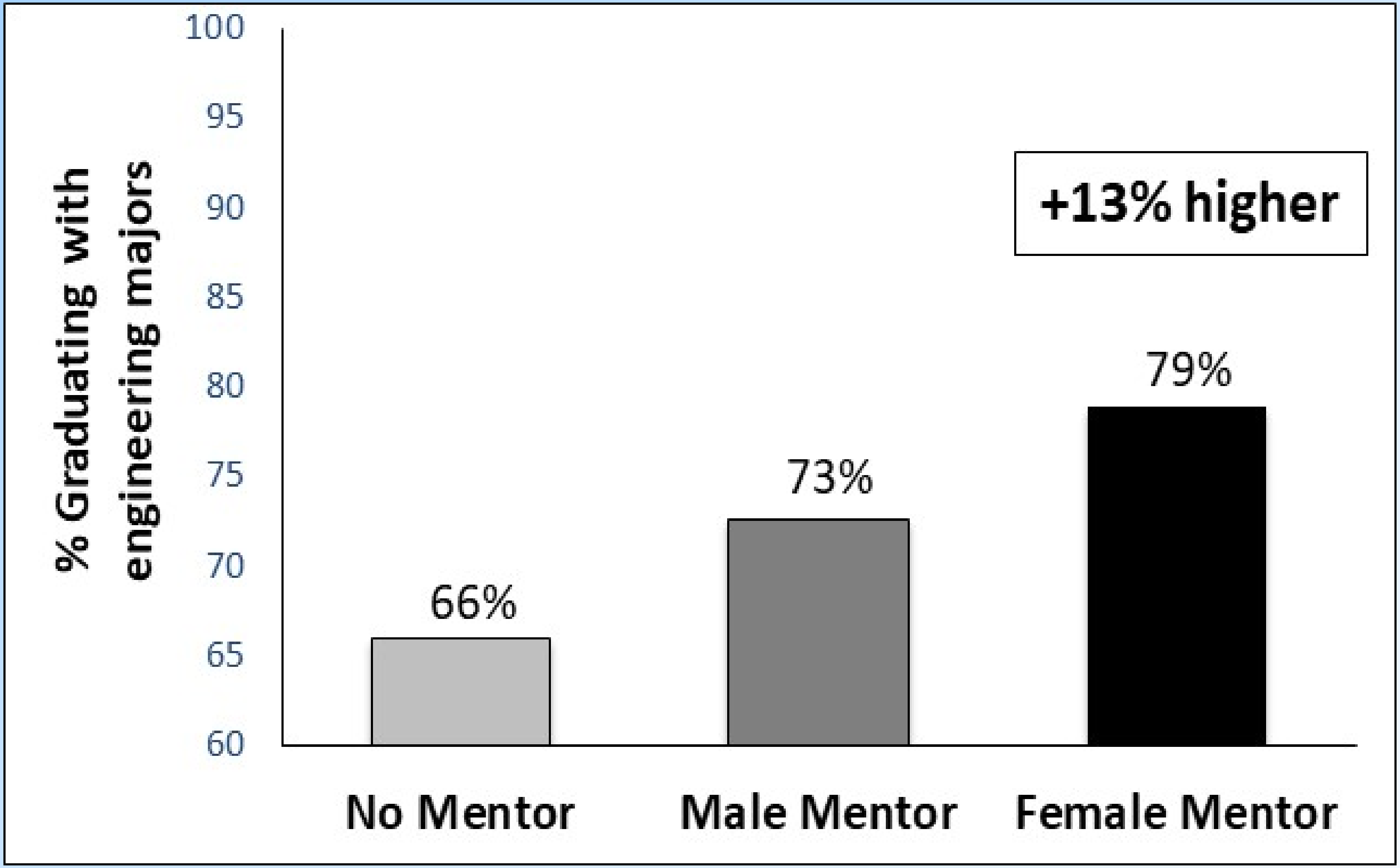
Wu, Thiem, & Dasgupta (2021)

% Success securing engineering internships



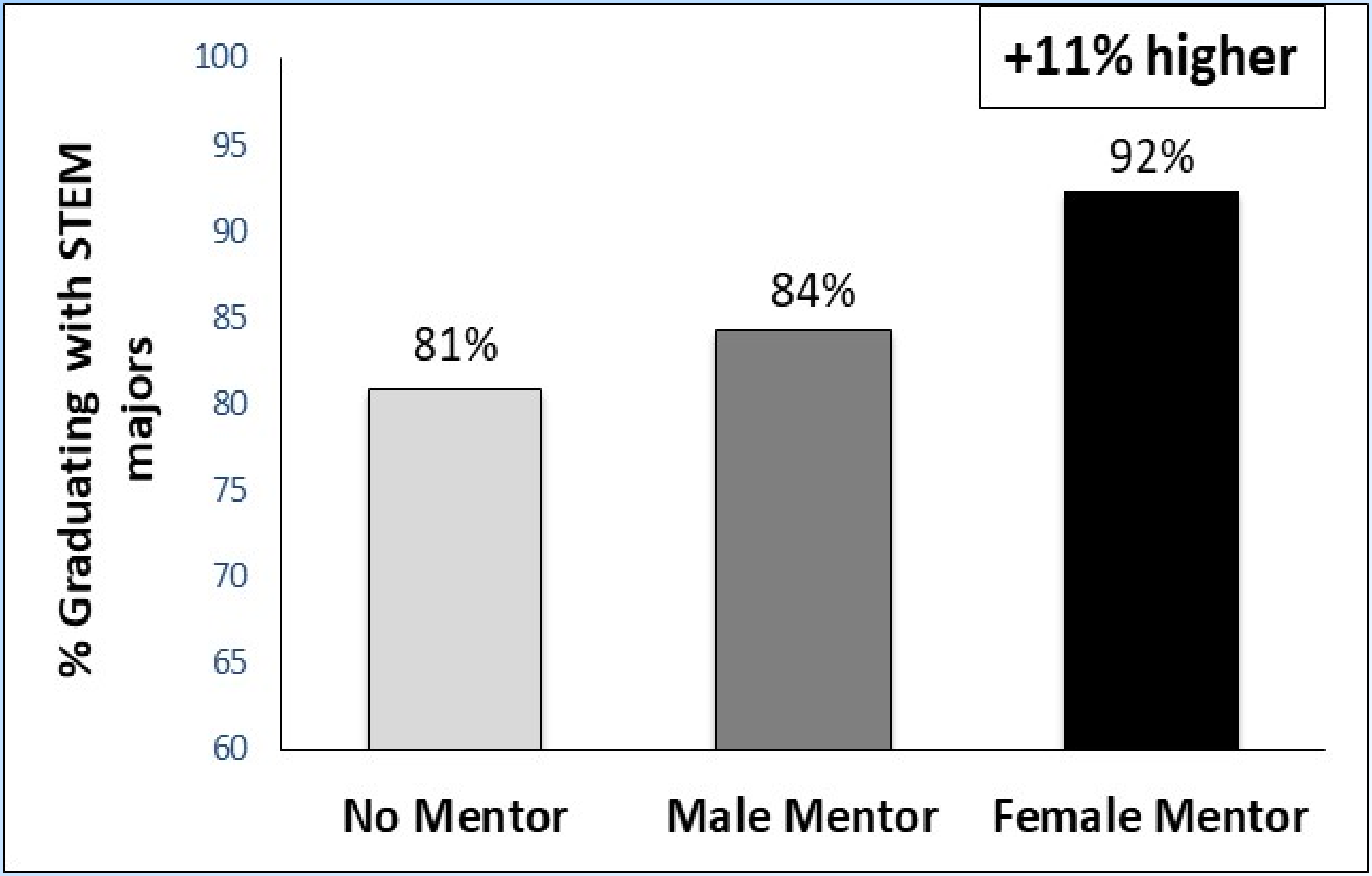
$\chi^2(1) = 4.79$, $p = .029$. Wu, Thiem, & Dasgupta (2021)

% Women graduating with engineering majors



Wu, Thiem, & Dasgupta (2021)

% Women graduating with STEM majors



Wu, Thiem, & Dasgupta (2021)

COMMUNITY

Living-learning community for first-generation students in STEM

Living learning community in biological sciences

Recruited first-generation college students in first year of college.

Randomly assigned to living learning community vs. control condition

Race & ethnicity: 27% Black, 12% Latinx, 21% Asian, 36% White, 4% other race/ethnicity.

Sex: 69% female, 31% male.

Features of the living learning community

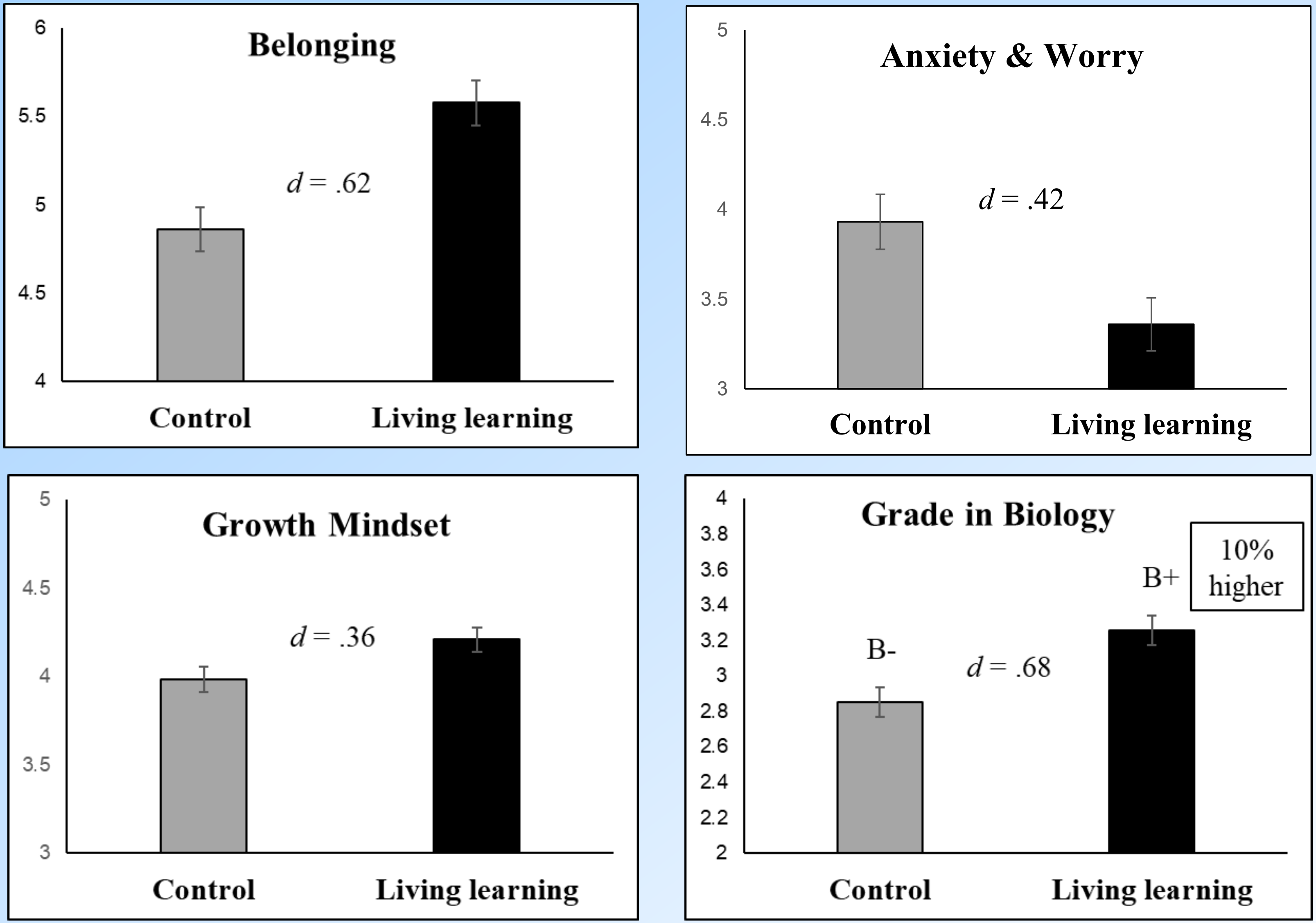
Living learning group: Many bonding opportunities for first-gens

- Took introductory biology as a cohort.
- First-gen peer mentor
- Students' roommate was also in the living learning group.
- Community building socials with first-gens

Comparison group (controls)

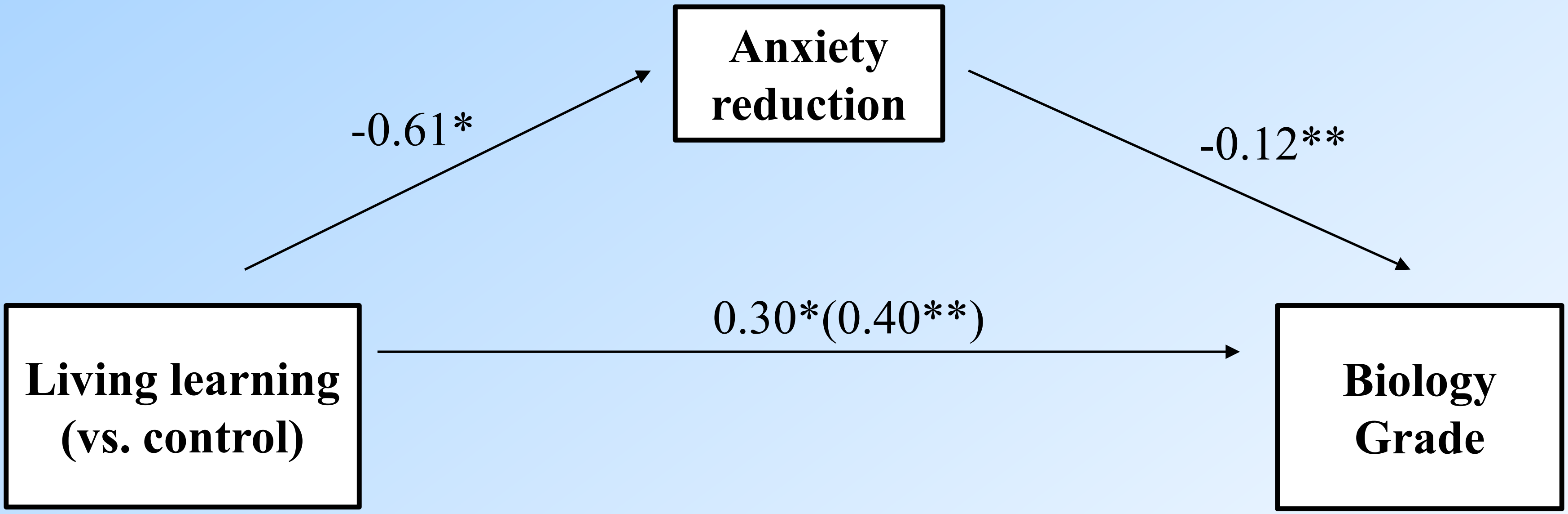
- Intro biology w/ non-first-gen students
- First-year seminar with non-first-gen students
- No peer mentor
- Roommate not matched by major or first-gen status.
- No community building socials with first-gens

Belonging, anxiety, mindset, & grades



Wu, Gibson, & Dasgupta (2021).

Living learning community predicts better grades through reduced anxiety



*$p < .05$; **$p < .01$

Hayes' PROCESS Model 4 with 5,000 bootstrapping samples

Indirect effect: $B = 0.07$, $SE = 0.04$, 95% CI [.01, .18]

The take-away

- Low cost programs that foster relationships and community with similar others act as social vaccines allowing young people to thrive in STEM.
- Focus on fixing learning environments, not fixing students.
- These programs work because they satisfy students' need to belong and need to feel competent.
- These psychological indicators are more powerful predictors of student persistence more so than performance.
- The "sweet spot" for these programs are during transition periods in life when young people find themselves in new unfamiliar environments.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